DT09 Rec'd PCT/PTO 11 MAR 2005
PCT/IB2003/003687
10/527413

A LEAF TRAP DEVICE

FIELD OF INVENTION

THIS INVENTION relates to a leaf trap device. It relates particularly to a leaf trap device for use with a water recirculation system including a pump, a filter device and a series of pipes along which water can be pumped from the swimming pool through the filter device for filtering the water and thereafter returned to the swimming pool.

BACKGROUND TO INVENTION

Swimming pools typically have a weir that is connected to an inlet pipe of a water recirculation system which conveys water from the swimming pool to the filter device for filtration of the water. A suction pool cleaner connected to the inlet pipe of the water recirculation system is typically used for sucking leaves up from the bottom of the pool.

It is known to locate a perforated basket in the weir to serve as a leaf trap for trapping leaves contained in swimming pool water before the water enters the water recirculation system. A problem associated with such leaf traps is that they require regular cleaning. A further problem is that as the leaf trap fills with leaves, the suction pressure of the water recirculation system and as a consequence, of the suction pool cleaner, is affected.

Any reference herein to a "leaf" or "leaves" must be interpreted to include a reference to any material or debris that collects in a swimming pool.

It is an object of the present invention to ameliorate the abovementioned problems associated with existing leaf traps.

SUMMARY OF INVENTION

According to the invention there is provided a leaf trap device for use with a swimming pool having a water recirculation system, the leaf trap device being connectable to the water recirculation system and comprising

a tank having a water inlet opening through which water from the swimming pool can enter the tank, a water outlet opening through which water can be discharged from the tank and a leaf discharge opening through which leaves which collect in the tank, in use, can be discharged from the tank;

a filter device that is located in the tank for separating leaves from water entering the tank through the water inlet opening, the filter device being operable to allow the passage of water but preventing the passage of leaves therethrough, the filter device having a configuration which divides the tank into a first compartment in which said water inlet opening and said leaf discharge opening are located and wherein leaves entering the tank are trapped, in use; and a second compartment in which said water outlet opening is located;

a discharge valve that is located in the leaf discharge opening and that is displaceable between an open condition wherein water in the tank and leaves trapped in the first compartment thereof can be discharged from the tank, and a closed condition wherein the leaf discharge opening is closed off; and

control means that is connectable to the pump of the water recirculation system, for switching the pump on and off and that is operable to control opening and closing of the discharge valve.

The discharge valve may include a valve seat which surrounds the leaf discharge opening and a piston/cylinder mechanism including a valve member that is connected to the piston of the piston/cylinder mechanism, the piston being displaceable between a retracted condition wherein the valve member is spaced form the valve seat thereby opening the leaf discharge opening and an extended condition wherein the valve member is seated against the valve seat thereby closing off the leaf discharge opening.

The cylinder of the piston/cylinder mechanism may be connectable to a water mains supply for displacing the piston and thereby the valve member into said open and closed conditions under water mains pressure.

The flow of water into the cylinder of the piston/cylinder mechanism may be controlled by means of cylinder valves, the operation of which is controlled by the control means.

The tank may include an auxiliary water inlet opening that is connectable to a water mains supply and through which the tank can be filled with water from the water mains supply after water has been discharged therefrom through the leaf discharge opening, for priming the tank.

The leaf trap device may include a primer valve for controlling opening/closing of the auxiliary water inlet opening.

The control means may be connected to the primer valve and is operable to control the operation of the primer valve in an arrangement wherein the primer valve is opened when displacement of the piston of the piston/cylinder mechanism commences, for displacing the valve member of the discharge valve into a closed condition.

The leaf trap device may include an air vent non-return valve, for allowing air within the tank to be vented therefrom as water enters the tank when the tank is primed, in use.

The leaf trap device may include at least one water jet that is connected to said auxiliary water inlet opening for directing a spray of water when the auxiliary water inlet opening is opened, at the moveable valve member of the discharge valve, for cleaning debris therefrom prior to the valve member becoming seated against the valve seat, in use.

The control means may be in the form of an electronic programmable control device which is operable to control switching of the pump on and off and to control opening and closing of the cylinder valves and the primer valve.

The control means may be operable to commence a leaf scavenging cycle for discharging leaves from the tank by, in sequence, switching off the pump, actuating the cylinder valves to cause the retraction of the piston of the piston/cylinder mechanism to open the discharge valve and after a predetermined period of time allowing for water and leaves to be discharged from the tank, actuating the cylinder valves to cause the extension of the piston for closing the discharge valve and simultaneously opening the primer valve for cleaning the valve member and priming the tank, and switching the pump on after a predetermined time has elapsed sufficient to allow the tank to be primed with water.

The leaf trap device may include a pressure sensor for sensing water pressure within the tank, the control means being connected to the pressure sensor for receiving an input therefrom and being operable to commence a leaf scavenging cycle in response to the pressure dropping below a predetermined reference pressure valve.

BRIEF DESCRIPTION OF THE DRAWINGS

Further features of the invention are described hereinafter by way of a non-limiting example of the invention, with reference to and as illustrated in the accompanying diagrammatic drawings. In the drawings:

Figure 1 shows a schematic sectional side view, showing hidden detail, of a leaf trap device in accordance with the invention;

Figure 2 shows a schematic block diagram of a water recirculation system for a swimming pool, illustrating the manner in which a leaf trap device in accordance with the invention, is connected in line with the water recirculation system;

Figure 3 shows an enlarged, fragmentary, schematic sectional side view, showing hidden detail, of the discharge valve of the leap trap device of Figure 1;

Figure 4 shows a schematic, fragmentary top plan view, showing hidden detail, of the leap trap device of Figure 1;

Figure 5 shows a schematic, fragmentary end view, showing hidden detail, of the leaf trap device of Figure 1, as viewed along direction indicator arrow B of Figure 1; and

Figure 6 shows a schematic, fragmentary side view, showing hidden detail, of detail A of Figure 5.

DESCRIPTION OF PREFERRED EMBODIMENTS

With reference to the drawings, a leaf trap device in accordance with the invention, is designated generally by the reference numeral 10. The leaf trap device is adapted for use with a water recirculation system including a series of pipes and a pool pump and pool filter, for pumping water from a swimming pool through the pool filter and thereafter discharging the water back into the swimming pool. As such, the leaf trap device 10 is connected in line with an inlet pipe 12 which extends between the swimming pool and the pool pump/pool filter.

The leaf trap device 10 comprises, broadly, a housing structure 14 including a water tank 16 in the form of a water tank compartment 18 of the housing

structure 14, a filter device 20 that is mounted within the water tank compartment 18, a discharge valve generally designated by the reference numeral 22, and control means in the form of a control unit designated generally by the reference numeral 24.

The housing structure 14 has a generally rectangular shape and has four legs 26 for elevating the water tank 16 above a ground surface on which the housing structure is located.

The tank compartment 18 has a viewing window 28 through which the inside of the tank compartment 18 can be viewed. The water tank 18 includes a water inlet opening 30 having a pipe 31 extending therefrom, to which the water inlet pipe 12 is connected and through which water from the swimming pool can enter the tank compartment 18. A non-return flap valve 33 is located in the inlet opening 30 which allows the flow of water into the tank compartment and prevents water and leaves from flowing from the tank compartment into the inlet pipe 12. The water tank 16 further includes a water outlet opening 32 having a pipe 35 extending therefrom, through which water from the tank compartment can be discharged. The pipe 35 is connected, in use, to the water-return pipe 13 for conveying water to the pool pump/filter. An access opening leading into the tank compartment 18, which is closeable by means of a cover 34, is defined in the top of the housing structure for providing access to the tank compartment for maintenance/repair work to be carried out.

The leaf trap device 10 includes a non-return air vent valve 36 located in the top of the housing structure and leading into the tank compartment 18 to allow air within the tank compartment 18 to be vented therefrom. The water tank 16 further includes a leaf discharge opening 38 near the base of the tank compartment through which leaves which collect in the water tank, in use, can be discharged from the tank compartment. The water tank 16 further includes floor panels 42.1 and 42.2 which are slanted downwardly to allow for water run-off when water is drained from the tank through the leaf discharge opening 38, in use.

The filter device 20 is in the form of a perforated sheet element that is mounted to the housing structure 14 within the tank compartment in an arrangement wherein the filter element divides the tank into a main compartment 44 including the water inlet opening, in which leaves entering the tank are trapped, in use, and a smaller discharge compartment 46 that includes the water outlet opening 32. The filter device 20 is removably mounted to the housing structure to permit its removal for maintenance/replacement purposes.

The leaf trap device includes three solenoid-operated valves 50.1, 50.2 and 50.3 which are housed, together with the control unit 24, within a control unit compartment 48. The solenoid valves 50.1, 50.2 (referred to as "cylinder" valves) and the solenoid valve 50.3 (referred to as a "primer" valve) are connectable to a water mains supply via hoses 51.1.

The discharge valve 22 includes a valve seat 40 and a valve control mechanism in the form of a piston/cylinder mechanism 52 which is mounted within a discharge valve compartment 54 of the housing structure 14. The valve seat 40 is in the form of a flange surrounding the leaf discharge opening 38, including an O-ring seal 41. The piston/cylinder mechanism includes a cylinder 56 having a piston 58 displaceably located therein. The piston/cylinder mechanism 52 is connectable via hoses 60.1 and 60.2 to the solenoid valves 50.1 and 50.2. The discharge valve includes a removable valve member in the form of a valve disc 60 that is connected to a distal end of the piston 58.

The piston/cylinder mechanism 52 is operated using water pressure supplied by the water mains supply. As such, the cylinder valves 50.1 and 50.2 control the flow of water into the cylinder 56 thereby causing retraction/extension of the piston 58 for opening/closing the leaf discharge opening 38. The displacement of the piston and thereby the valve disc 60 is controlled via opening and closing of the solenoid valves 50.1 and 50.2, with water being discharged from one side of the cylinder as water enters the other side of the cylinder. As such, when one valve allows the flow of water into one side of the piston in the cylinder, the other valve permits water to be discharged from the other side of the cylinder. In a closed position of the discharge valve, the piston is held in an extended position by water pressure in the cylinder. The valve disc 60 is thus displaceable between a closed position as shown in Figure 3 of the drawings wherein the valve disc forms a water-tight seal with the valve seat 40, thereby closing off the leaf discharge opening 38, and an open position wherein the valve disc is

spaced from the valve seat 40 thereby allowing water and leaves within the tank compartment 16 to be discharged therefrom through the leaf discharge opening 38. The housing structure 14 includes a mounting plate 62 defining a hole 64 within which the piston 58 is slideably located and to which the cylinder 56 is mounted. A rubber O-ring seal 59 provides a water-tight seal between the piston 58 and the cylinder 56. Rubber U-ring seals 61.1 and 61.2 act between the piston 58 and the cylinder 56 to provide a water-tight seal between the chambers of the cylinder.

The housing structure 14 includes a scavenging chamber 66 into which water and leaves discharged from the tank compartment 18, is discharged and within which the valve disc 60 is movable between its open and closed conditions. The scavenging chamber 66 includes an outlet opening 68 which leads into an outlet pipe 70 to which a flexible hose 72 is connected for conveying water and leaves discharged form the tank compartment 18 to waste.

The water tank 16 includes an auxiliary water inlet opening 74 that is connected to the primer valve 50.3 via a hose 51.2. The primer valve 50.3 controls the flow of mains supply water through auxiliary water inlet opening 74. The control unit 24 controls the operation of the primer valve 50.3 causing it to open to allow the flow of water into the tank compartment 18 when the piston 58 commences displacement into an extended condition for closing the discharge valve 22 and thereafter causing the valve 50.3 to close after the valve 22 has closed. A number of specially-directed water jets 75 are connected to the inlet opening 74.

The purpose of the auxiliary water inlet opening 74 and the water jets shall be explained in more detail hereinafter.

The control unit is connectable to the pump of the water recirculation system for switching the pump on and off and is operable to control opening and closing of the discharge valve 22. The control unit is the form of an electronic programmable control device which includes a timer and which can be programmed to switch the pump on and off and control the operation of solenoid valves 50 for controlling opening and closing of the discharge valve 22 and the auxiliary water inlet opening, at predetermined time intervals. The control unit operates in an "automated" mode wherein the switching of the pool pump on and off and the opening and closing of the discharge valve 22 is pre-programmed to occur at preset time intervals. The control unit also operates in a "manual" mode wherein the pump can be switched on and off and the solenoid valves 50 operated manually for opening and closing the discharge valve 22 and the auxiliary water inlet opening 74.

In use, in the automated mode, the control unit is programmed to commence a "leaf scavenging cycle" wherein the pool pump is switched off at a predetermined time and the valve 22 is thereafter displaced into an open position. When the discharge valve 22 opens, air is sucked into the tank via the flexible hose 72 due to the partial vacuum in the tank compartment caused by the water being sucked through the tank compartment during the pumping cycle. This causes air bubbles to rise up in the water in the tank causing leaves and

other debris to be forced into suspension which assists the scouring of the water tank. After a predetermined time allowing all of the water to be discharged from the water tank, the solenoid valve controlling the flow of water into water hose 60.2, is opened and water from the water mains supply flows into the cylinder 56 exerting a force on the piston causing it to be displaced into an extended position until the valve disc 60 is seated against the valve seat 40 and the leaf discharge opening 38 is closed.

The control unit is programmed to cause solenoid valve 50.3 to open thereby permitting water from the water mains supply to flow via the water jets 75 into the tank compartment 18. The water jets 75 are specifically set to direct a spray of water at the valve disc 60 for cleaning any debris and/or leaves thereon as the valve disc closes. It will be appreciated that the displacement of the piston 58 into its extended condition is controlled so as to occur sufficiently slowly to provide sufficient time for cleaning of the valve disc 60 by the water jets to take place, thereby ensuring an effective water-tight seal between peripheral edge regions of the valve disc 60 and the valve seat 40. Water from the water mains supply continues to fill the tank compartment 18 via the water jets 75 until the tank is filled. This has the effect of priming the tank prior to switching on of the pool pump. The non-return air vent valve 36 allows the air which has entered the water tank to be vented from the tank compartment 18 as the water level rises within the tank. This prevents the air in the tank compartment from being displaced down the inlet pipe 12 towards the swimming pool or into a pipe of an automatic pool cleaner if such a pipe is connected to the inlet pipe of the water

reticulation system. After sufficient time has elapsed to allow the tank compartment to be primed with water, the pool pump is again switched on by the control unit 24.

The control unit can be programmed to operated in a so-called "idling mode" for use in circumstances wherein few leaves and/or other debris are expected to enter the leaf trap device. In this mode, the pump is switched on and off without activating the discharge valve to open and close.

In a particular embodiment of the invention, the leaf trap device 10 includes a pressure sensor 80 mounted in the outlet pipe 35. The sensor 80 is connected to the control unit 24 which is operable to receive as an input, a pressure value from the pressure sensor 80. The control unit 24 being operable to switch off the pool pump and commence a "leaf scavenging cycle", in response to the pressure sensor 80 sensing a pressure that is less than a predetermined reference pressure value. It will be appreciated that the pressure in pipe 35 is indicative of the amount of leaves and/or other debris that collects in the tank compartment 18 during a pumping cycle. As more leaves and/or debris collect in the tank compartment, the pressure in the tank compartment (and in the outlet pipe 35) will decrease accordingly. The Applicant envisages that the control unit 24 may be operable to control "leaf scavenging cycles" of the leaf trap device in response to inputs from the pressure sensor 80 only or in conjunction with inputs received from the timer. Hence, the leaf scavenging cycle may take place

in response to a pressure reduction in the tank compartment or at predetermined time intervals or both.

The control unit is connectable to an electrical mains supply, but has a rechargeable battery back-up to maintain the time of the timer in case of an electrical power failure.

The Applicant believes that the leaf trap device in accordance with the invention obviates the need for regular manual cleaning of leaves from the water reticulation system which, if not cleaned regularly, will lead to clogging up of the system rendering an automatic pool cleaner connected thereto, ineffective and leading to possible overheating of the pool pump.